

SINGAPORE'S ELECTRICITY AND GAS SECTOR:

The Competitive Market Moves Forward

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S U M M A R Y

The Singapore electricity and gas sectors have been progressively liberalized over the last five years, with the results a model for others in Southeast Asia. The generating segment is now fully competitive. There are seven operating or planned generating companies (gencos) supplying electrical power in Singapore; five of which are state-owned enterprises. Officials say the three wholly-state owned gencos are to be divested "when market conditions are right" either through tender or through initial public offerings (IPOs). The wholesale and retail electricity markets have been partially opened to competition, with the aim of giving users the ability to choose their power supplier. By mid-2004, some 10,000 of the largest customers – accounting for some 75% of total demand – will be designated as contestable, i.e., power suppliers compete to sell power to them. Some 50% of customers already designated contestable have opted to buy from the wholesale market. The vast majority of retail consumers remain non-contestable, and are supplied power by one company – Singapore Power (SP) Services. Power transmission and distribution will continue to be handled by a state-owned monopoly – SP PowerAssets.

Prices are determined in the wholesale market, although the Energy Market Authority (EMA, the energy sector regulator) has imposed vesting contracts on 65% of demand, in an effort to curb market power of the three largest gencos, which control 90% of the country's installed capacity. How much to vest and at what benchmark price will be reviewed once every two years. EMA calculates that the competitive market has reduced prices for customers by 9.5%, as it has created incentives for the largest gencos to switch from oil-fired steam generators to more efficient gas turbines.

Singapore is also liberalizing the gas market and encouraging greater use of natural gas. Singapore now receives natural gas from Malaysia and Indonesia via pipeline, and is in the process of phasing out use of manufactured gas by consumers and businesses in favor of natural gas. Over 60% of electricity is now generated by gas. Officials are studying sourcing liquefied natural gas (LNG) as well, to further diversify supply, especially after an interruption in one of the pipelines caused a disruption of Singapore's usually very reliable electricity supply.

Plans to divest the three wholly state-owned gencos were shelved in 2002, citing unfavorable market conditions. Divestment, either through sale or an IPO, poses challenges; in 2003, the three gencos collectively wrote off over S\$1 billion of existing plant, as gas has displaced steam generators, and more write-offs are possible. Meanwhile, Singapore Power and several other Singapore state-owned enterprises (SembCorp and Keppel) have become important investors in foreign generating and transmission facilities. SP International, for example, has investments in Australia, Taiwan, and South Korea. In its latest acquisition, SP International announced an intent to purchase a South Australian genco from U.S.-based TXU for some US\$3.6 billion.

More information on the energy market is available from <http://www.ema.gov.sg>

A Statistical Overview

Consumption of electricity in Singapore is about 6,151.54 kWh per person (2001 data), placing it as the 29th highest consumer of electricity worldwide, and 4th highest in Asia, according to the nationamaster.com Internet site, using data from the U.S. Department of Energy. The site also ranked Singapore as the 8th highest country worldwide (and 2nd in Asia) in terms of electricity generation ability per person, with 1.45 kW per person. Analysts expect demand to grow at 4-5% annually.

As of end-2003, Singapore's total installed generation capacity was 8,919 MW, compared with peak demand of 5,139 MW. EMA requires the gencos to maintain 30% reserve capacity, which brings total required capacity to around 6,500 MW. The significant excess capacity is mainly a result of the conversion of oil-powered plants to gas, in an effort to maintain competitiveness in a liberalized market. Some 60% of Singapore's electricity generation is now fueled by natural gas. Three state-owned generating companies - PowerSeraya, Senoko Power and Tuas Power - together account for more than 90% of Singapore's electricity supply, several smaller gencos or co-generation facilities account for the other 10%. Singapore has some 22,500km of underground cable, with total transmission and distribution assets of some S\$6.5 billion (US\$3.8 billion).

Table: Electricity Generation and Sales (GWh)

<u>Generation</u>	<u>Sales</u>
1998	28,283
1999	29,520
2000	31,665
2001	33,089
2002	34,665
2003	35,331

Source: Energy Market Authority

SP PowerAssets Ltd owns the transmission and distribution network for the delivery of electricity from generation companies to consumers. SP PowerAssets appointed SP PowerGrid Ltd., also a subsidiary of Singapore Power, to maintain and operate the transmission and distribution network, and to install and maintain electricity meters at consumers' premises.

Singapore imports natural gas via pipeline from Malaysia and Indonesia, and also uses manufactured gas. Imports of natural gas from Malaysia totaled S\$12.5 million in 2003 (US\$7.3 million). Statistics on natural gas imports from Indonesia are not released. Gas consumption is very small in Singapore as with countries such as Japan and Hong Kong. Fortunately, Singapore's neighboring countries have large natural gas resources. In 2003, gas production and sales were about even, at 1,361 million units and 1,372 million units, respectively.

Deregulating the Energy Market

Liberalization of the energy market in Singapore began in October 1995 and remains a work in progress. Prior to 1995, the Public Utilities Board (PUB) owned and managed power generation, distribution and retailing. This structure served Singapore adequately for three decades. However, in the mid-1990s the Government concluded that the regulated system should be liberalized (similar to that of the telecommunications sector). The government calculated that a competitive market would likely reduce energy costs for large industrial users, thereby ensuring Singapore's continued competitiveness, particularly for the energy-intensive semiconductor and chemical industries - cornerstones of Singapore's industrial strategy.

The move towards greater competition began in 1995, when the Government corporatized the PUB's electricity and piped gas businesses, grouping a number of successor entities under a holding company, Singapore Power, which became 100% owned by Temasek Holdings, the Government's umbrella trust for most state-owned enterprises. These successor entities grouped under Singapore Power included:

- Two power generation companies -PowerSenoko (now Senoko Power) and PowerSeraya, which supplied more than 80% of Singapore's power;
- One transmission and distribution company - PowerAssets;
- One electricity retail company - Power Supply;
- One gas supply company - PowerGas.

In addition, the government set up a separate power generation entity under the ownership of Temasek Holdings, Tuas Power, which started operations in 1999 and now contributes some 11% of total electricity generated in Singapore.

The Government opened the market to independent power producers (IPPs) and co-generators. No limits were placed on the number of entrants in the generating segment, but Singapore's small size and surplus generating capacity has diminished the market's attractiveness to new entrants. Like the three successor power gencos noted above, the IPPs were licensed and regulated by the PUB, but could initially only sell electricity generated to PowerGrid. The IPPs include SembCorp Cogen, Island Power (owned by Bechtel and Sime Darby) and Keppel Merlimau CoGen. On April 1, 1998, the Government implemented a wholesale electricity market, known as the Singapore Electricity Pool, administered by PowerGrid, to facilitate electricity trading between gencos and Singapore Power, as a prelude to opening the retail segment to competition.

A New Competitive Framework

In March 2000 the Government announced a second phase of liberalization, including separation of the contestable and non-contestable segments of the industry, the establishment of an independent system operator, and the liberalization of the retail market. The announcement came amid increasing concerns that the structure of the electricity market was inhibiting greater competition, and not reducing costs. As such, officials moved to separate clearly the competitive parts of the market from the parts that constituted a natural monopoly.

On April 1, 2001, a new pro-competitive legal and regulatory framework for the electricity and natural gas sectors in Singapore took effect. The framework, based on a series of bills passed by the Singapore Parliament, restructured and liberalized the power sector, opening up electricity generation and distribution, and gas importation and distribution, to full competition, in some areas immediately and in others in stages. Government officials state that the reforms were intended to provide “an electricity market structure and regulatory framework that will support a competitive industry, while ensuring that reliability and security are looked after”.

The following legislation underpins the reforms:

Public Utilities Act

Removal of energy market regulatory functions from the Public Utilities Board (PUB). PUB retained management of Singapore’s water system and took on the responsibility for the sewerage system, which was under the Environment Ministry. PUB was transferred to jurisdiction of the Environment Ministry, from the Ministry of Trade and Industry (MTI).

Energy Market Authority of Singapore Act

Established the Energy Market Authority (EMA), an agency under the Ministry of Trade and Industry, to assume regulatory responsibilities from the Public Utilities Board over the electricity and gas sectors.

Electricity Act

Provides a competitive market framework for the electricity sector, including a competition policy framework.

Gas Act

Provides a competitive market framework for the gas sector and the safety, technical and economic regulation of the transportation and retail of gas.

Also in April 2001, the Government transferred ownership of Senoko Power and PowerSeraya from Singapore Power to Temasek Holdings. The two gencos operate as independent companies wholly-owned by Temasek Holdings. At the time officials stated that Senoko Power and PowerSeraya, like Tuas Power, would be divested, but in 2002 Temasek deferred divestment indefinitely, citing unfavorable market conditions. Observers say that the problems with Enron

and other U.S. energy firms reduced the pool of potentially interested bidders. As of May 2004, a date for their divestment still has not been set. Singapore Power retained ownership of transmission and distribution assets, so that its core business focused on electricity and piped gas transmission and distribution, market support services and integrated billing service, and engineering consultancy.

The new legal and regulatory framework designates the roles of players in the market through the type of license they hold and sets out a competition policy framework. No player can participate in the market without a license/licenses from, or approval of EMA. The different license categories are:

- Generation License: held by Senoko Power, PowerSeraya, Tuas Power, SembCorp Cogen, Keppel Merlimau, Island Power and the National Environment Agency.
- Retail License: held by Seraya Energy, Senoko Energy Supply, Tuas Power Supply, SembCorp Power, Keppel Electric.
- Wholesale Market Operator: held by the Energy Market Company (EMC), a joint-venture of EMA (51%) and New Zealand's MCo (49%).
- Transmission License: held by SP PowerAssets
- Market Support Services License: held by SP Services.
- Power System Operator: a division of EMA, set up to ensure the reliable and secure operation of the power system.

A New Competitive Market: January 2003

Contestable vs. Non-Contestable

With the regulatory framework in place, EMA launched the new competitive electricity market on January 1, 2003. In working towards this goal, EMA grouped consumers into contestable (large, non-domestic consumers) and non-contestable categories (mainly households). Under the new system, electricity customers in Singapore do not buy direct from gencos; rather, they can choose to buy electricity from a licensed retailer, directly from the electricity wholesale market or through SP Services. Customers are categorized as "contestable" or "non-contestable", depending on their annual electricity usage. Contestable customers can buy directly, apart from the wholesale market, from any of the licensed retailers. Non-contestable customers can only buy from SP Services, which is responsible for providing electricity supply to non-contestable customers as well as support services such as opening of accounts, reading of meters and billing.

In July 2001, users of 2 MW or more were given the choice of buying electricity from any of the gencos through electricity retailers. As of January 2003, the 250 largest customers were categorized as "contestable". Up to end-2003, EMA has approved 5,000 contestable customers under Phase 1 of EMA's timeline for contestability in the electricity market. Those designated contestable could either opt to buy under variable or fixed-price contracts, or could buy directly

from the wholesale pool (see below). As of end-April 2004, the number of contestable consumers has increased to 5,250, covering some 70% of total electricity demand.

As part of Phase 2, EMA has targeted to approve another 5,000 contestable consumers with an average monthly consumption of 5,000 kWh or more by end-2004. By then, about 75% of customers will be able to choose their supplier. EMA says it is working out details for full retail contestability of all remaining 1.1 million consumers with average monthly consumption of less than 10,000 kWh, but that full implementation is likely to take 3-4 years. Officials say the approach is likely to be an opt-in, voluntary system that also allows small customers to aggregate demand so that they can achieve economies of scale and greater bargaining clout. SP Services will continue to serve these consumers until such time when EMA opens competition in this segment.

Wholesale Market and Prices

Electricity prices are determined by the wholesale spot market, managed by the EMC. Generation companies bid every half hour to supply electricity to the wholesale market. Participants of the wholesale market are EMA-approved retailers and any other party approved by EMA. Some 50% of contestable customers have opted to buy from the wholesale market.

As of January 1, 2004, EMA has imposed vesting contracts on the gencos as part of its on-going control of their market power, and in order to protect consumers from excessive price volatility. The contracts in effect cap prices on some 65% of supply, with the vesting price set at the long-run marginal cost (LRMC) of the most efficient generation technology in use (combined-cycle gas turbines). The LMRC for the combined-cycle gas turbines includes the cost of assets, running costs, and financing cost, and was determined for EMA by outside consultants. Each of the three principal gencos, who collectively account for 90% of electricity generation in Singapore, have to sell 30% of installed generation capacity into the wholesale pool at the vesting contract price.

EMA officials say the vesting contracts put further pressure on these gencos to become even more efficient, since it rewards them for using the most efficient technologies (i.e., they are unable to pass through to consumers the cost of inefficient technologies). EMA says it also creates incentives for new efficient new producers to enter the market.

Transmission/Distribution Monopoly

Under Singapore's liberalization strategy, Singapore Power subsidiary SP PowerAssets will remain as the sole operator for network of transmitting and distributing electricity, as well as installing electricity meters in consumers' premises. SP PowerAssets has to get the approval of EMA for any new businesses it intends to take up in Singapore. The entity is expected to continue to invest heavily in upgrading the facilities, such as its underground cable tunnel network, now under development. EMA says it has benchmarked PowerAssets' performance against grid operators overseas to ensure cost competitiveness.

Import and Export of Electricity

EMA is prepared to allow electricity imports and exports of up to 600MW, with the limit based on security considerations. However, EMA says the foreign source or destination country would need to have market rules similar to those in Singapore. Thus far, neither of Singapore two neighbors, Malaysia or Indonesia, satisfy that criteria.

Liberalization – An Assessment

Prices

Officials took care not to equate liberalization with cheaper electricity. Rather, officials have said that, other factors remaining the same, liberalization would improve market efficiency, and that this would lower costs. Officials state that prices have fallen 9.5% due to liberalization alone, with all the gains passed to customers. But large industrial customers have clearly been the major beneficiaries of liberalization thus far.

EMA appears satisfied with the results of the vesting contracts. Officials say that the average wholesale energy settlement price has decreased by 10% to S\$83.74/MWh since January 1, 2004. Some of the gencos assert, however, that under the current system, they will be unable to replace a plant when it runs down. The CEO of one genco voiced that this situation is not sustainable long-term; many analysts agree, questioning whether there is a need for such a high level of vesting.

EMA's CEO says that how much demand should be subject to vesting contracts, and at what price (i.e., LRMC), is subject to periodic review by a consultant, and that an initial review is currently underway. He indicated that if the consultant recommends any changes, EMA will request industry and consumer feedback before implementing any of the recommendations.

Consumers

One of the goals of liberalization is to give customers the freedom to choose their own power supplier. It is clear that the largest consumers of electricity have seen positive changes from liberalization. Competition is likely to expand modestly once the entire market is contestable. While electricity retailers are likely to offer better pricing options and incentives, costs for most household consumers are unlikely to see dramatic reductions, leading many to stick with the existing dominant (former monopoly) retailer, SP Assets, until they see a significant price advantage in switching.

Generation

As generating capacity at end-2003 was already some 74% higher than the optimal 30% reserve capacity, according to EMA, one might question moves to add new capacity. Yet the vesting contracts create incentives to maximize use of the most efficient technologies, even if this means building new units. For example, Tuas Power is building two more blocks of gas-fired combined cycle power plants to complement its two existing blocks. All three gencos are also in the process of upgrading their efficiency. Tuas Power is the most efficient at present, with the highest profitability per MW of installed capacity. The largest genco, Senoko Power, is converting its oil-fired steam plants to gas-fired plants at a cost of about US\$30 million. PowerSeraya is converting its fuel oil fired plants to using a new fuel called Orimulsion, which is reported to be less expensive than fuel oil. All the gencos, including SembCorp Cogen, which owns a 815-megawatt combined cycle co-generation plant on Singapore's chemical Jurong Island, are geared towards using more natural gas for fuel.

A question mark hangs over the whether the three main gencos will be divested, and if so, how and when. Dow Jones Newswires quoted Singapore Minister of State for Foreign Affairs and Trade & Industry Raymond Lim as saying in October 2003 that the Government has no objection to 100% privatization, but how much to divest and when it might occur is for Temasek to decide. In an aborted sale of Tuas Power in 1999, the Government had restricted bidders to Singapore-incorporated companies, thus restricting foreign power generation companies from participating as lone bidders. Analysts do not expect that to be the case again; in any event, such a restriction would be inconsistent with Singapore's commitments under the US-Singapore Free Trade Agreement, which entered into force on January 1, 2004.

In 2002, Temasek had reportedly said it would defer putting the gencos on the market until market conditions improved. Observers say the reason for the action was the post-Enron global pull-back of many U.S. energy firms, which effectively removed a number of possible bidders from the market. Officials say that divestment will come "when market conditions are right". How divestment will proceed is unclear -- the gencos could be sold by tender or could be launched as publicly-traded companies through a stock offering. Some observers believe the latter approach may be more likely. Still, while Singapore is a relatively small electricity market, several foreign firms are thought to be interested in the privatization, although any investment would be made through consortia led by local partners. Either way, there are significant asset liability problems that will first need to be overcome. In 2003, the gencos had to write off some S\$1 billion in fuel oil-fired generating assets. Some observers assert that, for divestment to work, Temasek could have to swallow billions more in write-offs.

If a sale-by-tender process is selected for divestment, analysts say another critical element - and a lesson learned from the aborted Tuas tender - is that competition will not be served if the three gencos have common ownership. Cross-ownership within the generation segment would run counter to goals of stimulating price-based competition. By contrast, cross-ownership between the generating and retail segments, which is being allowed currently, makes significant sense. But only a handful of companies, most notably SembCorp Power, appear keen to join the retail market, as the pie is small.

Gas

The Government wants to encourage greater use of natural gas, among households, vehicle fleet operators, and industries. In 1992, Singapore began importing gas from Malaysia to fuel generating units at the Senoko Power generating station. Gas from Indonesia's West Natuna field followed in 2001, under a 22-year contract with SembCorp; the gas is supplied to gencos and industrial users in the Tuas and Jurong Island areas of Singapore. Singapore Power contracted with Pertamina to buy gas from gas fields in South Sumatra over a 20-year period; gas started flowing in 2003. About 60% of Singapore's electricity is currently generated using natural gas. In addition, manufactured gas (i.e., town gas) is piped to some 500,000 domestic, commercial and industrial users through pipe installations covering 80% of Singapore households. The Government is in the midst of a five-year program to convert the existing town gas system to transport natural gas; in line with the program, the production of manufactured gas has been declining since 2001.

Table: Town Gas Sales
(million units)

	<u>Production</u>	<u>Sales</u>
1998	1,288	1,266
1999	1,323	1,307
2000	1,366	1,363
2001	1,391	1,372
2002	1,373	1,389
2003	1,361	1,372

Source: Energy Market Authority

Consumers of gas are categorized into domestic and industrial/commercial users. Domestic users can choose to buy gas through City Gas, which produces and supplies manufactured gas; or through distributors of bottled liquefied petroleum gas (LPG). Industrial and commercial users get their gas supplies from CityGas, while those in Singapore's western industrial zone (Jurong and Tuas Industrial Area) have a choice of several retailers: CityGas, SembCorp Gas and Gas Supply. Prices of gas are determined by the suppliers, subject to regulation by the EMA.

EMA says good progress has been made so far in the restructuring of the gas industry, although the liberalization process is behind that in the electricity market. Passage of the Gas Act in 2001 set the legal basis for a competitive market, separating the contestable and non-contestable parts of the market. As with the electricity transmission network, the gas transportation network will be considered a natural monopoly and run by PowerGas, a subsidiary of Singapore Power. EMA regulates PowerGas using the same framework it has for SP PowerAssets on the electricity side. PowerGas will be obliged to allow open and non-discriminatory access to the gas transportation system; its own functions will be limited to maintaining the network and monitoring gas quality. The retailing of natural gas to all consumers will be fully contestable as soon as the conversion of the town gas system has been completed.

EMA is in the process of developing a gas market; the software and IT systems to support it have been built and an implementation plan drafted. Large gas consumers, such as gencos, will buy gas directly from importers and traders. Bilateral contracts are likely to be the main form of gas trading, although a spot market may be developed in time. The Government would like to encourage the development of a capacity-rights trading regime for the gas market, whereby importers, retailers, and consumers would all be able to compete to purchase capacity-rights. However, the Government appears to recognize that such a market will only develop in the long-term, in part because existing capacity is tied up by long-term contracts.

Demand for natural gas should grow, from Singapore's expanding petrochemical industry, the gencos and from residential consumers who switch from bottled gas. Over 80% of new apartment buildings being built by the Government's Housing and Development Board (HDB) are equipped to use gas.

The Government is looking at the possible importation of liquefied natural gas (LNG) to provide an alternative (and reserve) supply of gas. This follows two disruptions in the transmission of gas from Indonesia's West Natuna field. In a February 2004 speech, Minister of State for Trade

and Industry Vivian Balakrisnan commented that the importation of LNG would also “provide us with the opportunity to introduce new players in the gas market, which would enhance competition”. He said the government was undertaking expert studies in proposals to import LNG, and hopes to have some findings by 2005.

Singapore's Energy Companies: Moving Abroad

While Singapore Power is no longer in the power generation business in Singapore, given the transfer of its generating assets to Temasek – it has ventured overseas into power generation and well as power engineering services and transmission network ownership. SP International owns a transmission network in the State of Victoria, Australia, as well as generating assets in South Korea and Taiwan. Most recently, SP International bid A\$5.1 billion (US\$3.6 billion) for the South Australian generating assets of Dallas-based TXU. Analysts and rating agencies reacted cautiously to the proposed transaction.

Other Singapore firms, including SembCorp and Keppel Group also have foreign power assets. SembCorp owns and operates plants with some 2,200MW of power capacity installed or in development, including in Australia, Vietnam, and China. Keppel Energy has power generation assets in Brazil and Nicaragua.

The state-owned gencos are also looking at opportunities overseas.